

REMARKS/ARGUMENTS

Claim 19 has been amended to provide proper antecedent basis for the photosensitive silver bromide and silver iodobromide grains. Claims 24-49 have been withdrawn in order to expedite prosecution of the remaining claims. Applicants reserve the right to prosecute the withdrawn claims in a future divisional application.

Restriction Requirement

The claims of this application have been restricted between group I (Claims 1 – 23, drawn to an article) and Group II (Claims 24- 49, drawn to a process). Applicants confirm their provisional election of Group I. While Applicants traverse this restriction requirement on the merits, the non-elected claims have been withdrawn and can be cancelled upon allowance of the Group I claims.

Rejections Under 35 U.S.C. §103

I. Claims 1-12 and 21-23 have been rejected as unpatentable over U.S. Patent 6,423,481 (Simpson et al. '481) taken with U.S. Patent 3,895,951 (Riester et al.).

II. Claims 13-18 have been rejected as unpatentable over Simpson et al. '481 taken with Riester et al., and U.S. Patent 6,440,649 (Simpson et al. '649).

III. Claims 19-20 have been rejected as unpatentable over Simpson et al. '649 taken with U.S. Patent 6,423,481 (Simpson et al. '481) and Riester et al.

Each of these rejections is respectfully traversed for reasons presented below. Each one is considered in turn after a brief discussion of Applicants' claimed invention.

Applicants' Invention

Applicants' claimed invention is directed to photothermographic materials comprising photosensitive silver halide grains that are chemically

sensitized using a combination of certain gold (III)-containing compounds and certain diphenylphosphine sulfide compounds.

Photothermographic materials are constantly being redesigned to meet ever-increasing performance, storage, and manufacturing demands raised by customers, regulators, and manufacturers. One of these demands is increased photospeed without a significant increase in fog (D_{min}) or a loss in D_{max} . Thus, while the particular gold (III)-containing compounds of Simpson et al. '481 and the diphenylphosphine sulfides in Applicants' claims may individually provide increased photospeed without a significant loss in other properties, there is a continued need for further improved photothermographic materials that have even greater photospeed.

Applicants have met that need. The present invention provides photothermographic materials having increased photospeed ("speed") by using the noted combination of chemical sensitizing compounds when compared to the use of gold (III)-containing compounds alone. It was also unexpectedly found that the combination of chemical sensitizers provides increased X-radiation sensitivity of the photothermographic materials. The evidence of these unexpected results is provided in the present application as follows.

Example 1 of the present application (pages 82-85) provides comparative data that is evidence of patentability over the teaching in the art. Several photothermographic materials were prepared, imaged, and evaluated using the described procedures. Comparative Example 1-1 contained no chemical sensitizer and Comparative Example 1-2 was prepared using a gold (III)-containing compound alone as a chemical sensitizer. Inventive Examples 1-1 through 1-5 were prepared using the combination of chemical sensitizers according to the present invention.

The sensitometric results obtained from these photothermographic materials are shown in TABLE I (page 85). The photospeed (measured on the Density vs. log E curve, SP-2) was measured and found to be increased in the materials of the present invention compared to both Comparative examples with only a small increase in D_{min} . In the case of SP-2, the increase was 56%, 64%, 35%, 39%, and 51% for Inventive Examples 1-1 through 1-5, respectively, using four different diphenylphosphine sulfides with Au-2 over the use of a gold (III)-containing compound alone (Comparative Example 1-2). Thus, Applicants have

demonstrated that the use of a representative combination of gold (III)-containing compounds and diphenylphosphine sulfides as chemical sensitizers provides unexpected photospeed increase over the use of the gold compounds alone.

Example 2 shows a similar unexpected increase in photospeed in the photothermographic materials of this invention (see SP-2 data of TABLE II, page 87). In addition, the materials of this invention demonstrated an improved response to X-radiation as evidenced by the greatly improved image discrimination between "developed density" and " D_{\min} " (see data in TABLE III, page 88). The Comparative photothermographic materials showed no image discrimination, i.e. developed density was the same as D_{\min} . Applicants' claimed invention showed considerable improvement.

Example 3 showed similar improvements in photospeed (SP-2) and image discrimination in a photothermographic material of this invention containing a high contrast agent over a similar material lacking the diphenylphosphine sulfide (see pages 89-91 and especially TABLES IV and V).

Examples 4 and 5 show similar unexpected improvements in photospeed (SP-2) and image discrimination with the photothermographic materials of this invention over similar materials lacking the diphenylphosphine sulfide (pages 92-96, TABLES VI-VIII).

Example 6 provides a highly relevant showing of unexpected results because it compares a photothermographic material of the present invention containing a combination of a gold (III)-containing compound and diphenylphosphine sulfide with a material similarly prepared but containing the sulfur-containing chemical sensitizer (S-1). Comparative Example 6-1 in the present application is essentially Example 3 of Simpson et al. '481 because they utilize the same gold (III)-containing compound (Au-2) along with the same sulfur-containing compound (S-1 in the present application is the same compound identified as S-VIII-1 in Simpson et al., '481). The data in TABLE IX (page 98) clearly show that while the two materials had essentially the same photospeed (SP-2), the material of the present invention provided lower D_{\min} and increased image contrast (both AC-1 and AC-2) even though diphenylphosphine sulfide compound PS-1 was present at 2.5 molar equivalents to Compound S-1. In addition, the two materials were compared for aging stability (TABLE X, page 99) and the material of the present invention was found to exhibit less change in

D_{\min} and image contrast upon aging over the material of Simpson et al. '481. Thus, the materials of the present invention are more stable over time compared to the material taught in Simpson et al. '481.

Similar results (i.e. lower D_{\min} , higher image contrast, image discrimination, and better aging properties) were also observed with the material of the present invention compared to a material of Simpson et al. '481 in Example 7 (pages 99-102, TABLES XI-XIII).

In Example 8 (pages 102-103), Applicants show that the presence of a diphenylphosphine sulfide compound in the photothermographic material provided significantly better photospeed and image contrast compared to the use of a triphenylphosphine sulfide that is outside the scope of the present invention. These results are evidence of unexpected results because Applicants do not claim the use of just any phosphine sulfide or phenylphosphine sulfide with the gold (III)-containing compounds. Rather, they claim the use of only certain diphenylphosphine sulfides in the noted combination. The use of phosphine sulfides outside of the claimed invention with gold (III)-containing compounds are less effective as chemical sensitizers. The data in TABLE XIV (page 103) indicate that the material of the present invention had improved photospeed and image contrast with comparable D_{\min} .

For the sake of brevity, Examples 9-12 are not discussed here in detail, but a careful reading of these examples in the present application (pages 104-115) reveals additional evidence of unexpected improvement in one or more of photospeed, image discrimination, image contrast, and D_{\min} compared to the use of gold (III)-containing compounds alone (Examples 9) or in combination with conventional sulfur-containing compounds as described in Simpson et al. '481 (Examples 10-12).

All of these examples provide overwhelming evidence of patentability because of the unexpected results achieved using the claimed combination of chemical sensitizers over known combinations of chemical sensitizers as well as over single gold (III)-containing chemical sensitizers. These results are not predictable from any of the art known to Applicants including the art cited in the Office Action.

Rejection I:

The Office Action alleges that Simpson et al. '481 discloses a photothermographic material substantially as claimed including combinations of chemical sensitizers including the sulfur-containing compounds S-VII-2 to IX-1. Riester et al. is cited for its teaching of the use of phosphine sulfides to stabilize the merocyanine dyes. While it is recognized that Simpson et al. '481 fails to teach phosphine sulfide, they are considered to be known from Riester et al. and that it would be obvious to use those compounds in Simpson et al. '481 to "stabilize" the silver halide grains.

While it is uncertain what is meant in the Office Action by to "stabilize the sensitivity of silver halide emulsion that spectrally sensitizes with a merocyanine dye", Applicants believe that the rejection lacks merit for several reasons as outlined below.

Applicants' Rebuttal:

Applicants respectfully submit that the rejection of Claims 1-12 and 21-23 is in error because: (1) Riester et al. has been improperly combined with Simpson et al. '481 and the primary reference cannot support a rejection alone; (2) even if the two references are properly combined, no *prima facie* case for unpatentability has been made; and (3) even if the two references are properly combined, Applicants have provided an overwhelming showing of unexpected results over the combined teaching.

Riester et al. has been improperly combined with Simpson et al. '481. Riester et al. is directed to photographic materials containing a silver halide, which materials are processed after exposure, using wet photographic processing solutions (e.g. Col. 17, lines 30-44). Nothing in Riester et al. hints of "dry-processed" photothermographic materials and as is well known from dozens of publications, one cannot predict the utility of photographic components in photothermographic materials because of the very different imaging chemistries, conditions, and retention or lack of retention of imaging chemistries in the imaged materials. The differences between photothermography and photography are outlined on pages 2-4 of the present application and several references cited therein. Also, as noted on page 5 (lines 19-25), the effects of chemical sensitizers used in photographic emulsions and materials are not necessarily achievable in

photothermographic emulsions and materials. The best that can be said for such chemical components is that they would be “obvious to try” in photothermographic materials but without any reasonable expectation of success, merely trying the compounds in the photothermographic materials does not render such use unpatentable. Thus, without motivation in the art in general or in Riester et al. specifically, one skilled in photothermography would not consult Riester et al. to find “new” chemical sensitizers for use in the emulsions in Simpson et al. ‘481.

Without Riester et al., Simpson et al. ‘481 fails to support a *prima facie* rejection because there is nothing in that reference to hint of the use of Applicants’ diphenylphosphine sulfides for any purpose.

Even if Riester et al. could be properly combined with Simpson et al. ‘481, the combined teaching fails to provide a *prima facie* basis for unpatentability of the claimed invention.

Applicants agree that Simpson et al. ‘481 teaches chemical sensitization of photothermographic emulsions using a combination of gold (III)-containing compounds (same as Applicants’) with a variety of sulfur-containing compounds. Many of the preferred sulfur-containing chemical sensitizers in Simpson et al. ‘481 are obtained by decomposing sulfur-containing dyes onto silver halide grains according to the teaching in U.S. Patent 5,891,615 (Winslow et al.) as described in Col. 32 (line 10) to Col. 34 (line 35). Several of the examples in Simpson et al. ‘481 (notably Examples 1-10) were carried out using the teaching of Winslow et al. and sulfur-containing Compound S-VIII-1. The sulfur-containing compounds described in both Simpson et al. ‘481 and Winslow et al. do not include the diphenylphosphines used in the present invention. Thus, Simpson et al. ‘481 is deficient in teaching Applicants’ required combination of chemical sensitizers.

The Office Action attempts to supply the missing teaching with Riester et al. This attempt fails for the following reasons.

Riester et al. is directed to the use of a wide variety of phosphine sulfides in photographic materials. However, Riester et al. does not teach the use of such compounds as chemical sensitizers. Rather, those compounds are used as “supersensitizers” for spectral sensitizing dyes. In other words, they are used to enhance the performance of known spectral sensitizing dyes, and more conventional compounds are then used as chemical sensitizers (see Col. 1, lines

37-48; and Col. 15, line 69 to Col. 16, line 26). The Examiner's attention is also directed to Example 1 where the merocyanine dye is added to the emulsion as a spectral sensitizer (Col. 17, lines 3-5) not as chemical sensitizer. The phosphine sulfide compound was added and found to increase sensitivity of the spectral sensitizing dye (Table I). Similar teaching is found in the remaining examples. However, there is nothing to suggest chemical sensitization in the Examples using any type of compound let alone the phosphine sulfides.

One skilled in the art following the combined teaching of Riester et al. and Simpson et al. '481 would recognize that Riester et al. teaches the use of numerous conventional chemical sensitizers (Col. 15, line 69 to Col. 16, line 26). There is nothing in Riester et al. to suggest that the phosphine sulfides should be used as "chemical" sensitizers since they are used as "supersensitizers" only to enhance the sensitivity of the "spectral" sensitizers.

Thus, the combination of the two references fails to teach or suggest the presently claimed invention because it would teach the use of conventional sulfur-containing chemical sensitizers with the gold (III)-containing compounds from Simpson et al. '481.

In addition, Applicants have demonstrated that the use of diphenyl phosphine sulfides with gold (III)-containing compounds according to the present invention provides unexpected results compared to the materials of Simpson et al. '481 and Riester et al. Applicants would point to the above discussion of the comparative results shown in Examples 1-12 wherein the present invention was compared to materials containing only gold (III)-containing compounds, or to materials containing a combination of gold (III)-containing compounds and the sulfur-containing compounds of Simpson et al. '481 (and the incorporated Winslow et al).

In fact, Applicants have provided a direct comparison to Example 3 of Simpson et al. '481 (e.g. Applicants' Example 6). As noted above, Example 6 compared a photothermographic material of the present invention containing a combination of a gold (III)-containing compound and diphenylphosphine sulfide with a material containing the same gold (III) compound (Au-2) and chemical sensitizer (S-1 that is the same compound identified as S-VIII-1 in Simpson et al., '481). The data in TABLE IX (page 98) clearly show that while the two materials had essentially the same photospeed (SP-2), the material of the present invention

provided lower D_{\min} and increased image contrast (both AC-1 and AC-2) even though disphenylphosphine sulfide compound PS-1 was present at 2.5 molar equivalents to Compound S-1. In addition, the two materials were compared for aging stability (TABLE X, page 99) and the material of the present invention was found to exhibit less change in D_{\min} and image contrast upon aging over the material of Simpson et al. '481. Thus, the materials of the present invention are more stable over time compared to the material taught in Simpson et al. '481.

Thus, Applicants' claimed photothermographic materials exhibited one or more of the following improvements: increased photospeed, decreased D_{\min} , improved image discrimination for sensitivity to X-radiation, reduced aging problems, or improved image contrast, over the materials of the prior art and particular over the materials of Simpson et al. '481. These results are not suggested by any teaching in Simpson et al. '481 or Riester et al. because the results are not predictable from their teaching, individually or in combination.

In addition, Applicant would point to Example 8 of the present application that provides particularly useful evidence of unexpected results as it clearly shows from the data that not just any phosphine sulfide will provide an increase in photospeed. Applicants have demonstrated that Applicants' choice in phosphine sulfide structure is critical to achieving the unexpected results. These unexpected results are not predictable from any teaching in the cited references, and in particular Riester et al., because Riester et al. broadly describes the useful "intensifying" compounds as having hundreds of possible aliphatic, cycloalkyl, aralkyl, aryl, or heterocyclic "R" substituents (Cols. 1-2). Riester et al. gives no preferences for the "R" substituents but lists 87 examples of compounds "particularly suitable for intensifying the sensitization effect of silver halide emulsion layers achieved with merocyanines" as spectral sensitizing dyes (Col. 3, line 15 to Col. 10, line 33). Compound 1 in Riester et al. is triphenylphosphine sulfide that was tested in the Comparative Example 8-1 of Applicants' Example 8. Compound 1 was used in Examples 1, 3, 4, 5, 6, 7, and 8 of Riester et al. A few other compounds were also tested, but Compound 1 is clearly the preferred phosphine sulfide in Riester et al. from its predominance in the examples. Moreover, the Comparative Example 8-1 material contained one of the preferred gold (III)-containing compounds of Simpson et al. '481 (e.g. Au-2) that was demonstrated in many of the examples in Simpson et al. '481, including Example

3. Thus, it has been demonstrated that the use of Applicants' diphenylphosphine sulfides with gold (III)-containing compounds as chemical sensitizers provides unexpected results in photothermographic materials over a combination of the preferred phosphine sulfide in Riester et al. and a preferred gold (III)-containing compound of Simpson et al. '481.

For all of these reasons the rejection of the claims over Simpson et al. '481 and Riester et al. is in error and should be withdrawn.

Rejection II:

Dependent Claims 13-18 have been rejected over the combination of Simpson et al. '481, Riester et al., and Simpson et al. '649. This rejection is in error for the same reasons stated above in rebuttal of Rejection I. Nothing in Simpson et al. '649 overcomes the deficiencies in the other two references. Simpson et al. '649 is merely cited for its use of phosphors in photothermographic materials. While Applicants believe that Claims 13-18 are separately patentable over the combined three references, Applicants are not relying upon the recited phosphor for patentability of the generic invention. Rather, those dependent claims are also patentable because they are dependent upon patentable Claim 1. Thus, this rejection should be withdrawn.

Rejection III:

Claims 19 and 20 have been rejected as unpatentable over the combination of Simpson et al. '649 taken with Simpson et al. '481 and Riester et al. The Office Action alleges that Simpson et al. '649 discloses a photothermographic material substantially as claimed that contains a phosphor, gold (III)-containing chemical sensitizer, a sulfur-containing chemical sensitizer, or a combination thereof. Simpson et al. '481 is cited for its teaching of specific gold (III)-containing chemical sensitizers in Applicants' Claim 19 and Riester et al. is cited for its teaching of phosphine sulfides. Thus, the Office Action argues that it would be obvious to use the phosphine sulfides of Riester et al. with the gold (III)-containing compounds of Simpson et al. '481 in the photothermographic material of Simpson et al. '469.

While the Examiner has readily picked features from all three cited references without any motivation in the art to do so, the rejection is also faulty

for the same reasons stated above in rebuttal of Rejections I and II. Merely switching the order of references does not overcome the deficiencies that have already been described.

For the sake of brevity, Applicants will not repeat all of the arguments provided above. However, several important points are worth repeating. First of all, Riester et al. is not properly combined with either Simpson et al. '469 or '481 for the reasons cited above. Riester et al. is in the photographic art and the two other references are in the photothermographic art and there is no reason or motivation for the teachings of one art to be used with the teachings of the other art.

Secondly, even if properly combined, the teaching in Riester et al. is inconsistent with that in the two other references. The phosphine sulfides in Riester et al. are not taught as chemical sensitizers, but as "supersensitizers" to enhance the spectral sensitivity of merocyanine dyes in photographic emulsions. The combined teaching would suggest the use of different sulfur-containing compounds for chemical sensitization (such as the compounds described in Winslow et al. and Simpson et al. '481, Example 3).

Lastly, Applicants have supplied considerable evidence of unexpected results in Examples 1-12 of the present application. In particular, they have demonstrated that their claimed combination of chemical sensitizers provides various improved properties over the use of gold (III)-containing compounds alone, and more importantly, over the combination of chemical sensitizers taught in Simpson et al. '481 (e.g. see Applicants' Examples 6, 7, and 10-12). Applicants would further point out that the examples of Simpson et al. '649 used a combination of chemical sensitizers that is that same as the combination used in Example 3 of Simpson et al. '481. More specifically, the chemical sensitizers used in Simpson et al. 649 were Chemical Sensitizer A and Chemical Sensitizer B (Col. 32, lines 6- 20) that are the same compounds identified as "S-VIII-1" and "Au-2" in Example 3 of Simpson et al. '481. Applicants have demonstrated unexpected results over the combination of this art in at least their Example 6. Thus, Applicants have demonstrated unexpected results over the closest prior art that is cited in the Office Action.

For these reasons, this rejection should be withdrawn.

Obviousness-type Double Patenting Rejections

IV. Claims 1-12 and 21-23 have also been rejected under the judicially created doctrine of obviousness-type double patenting as unpatentable over Claims 1-7 and 26 of Simpson et al. '481 in view of Riester et al.

V. Claims 13-18 have been similarly rejected as unpatentable over Claims 1-7 and 26 of Simpson et al. '481 in view of Riester et al. and Simpson et al. '649.

VI. Claims 19-20 have been similarly rejected as unpatentable over Claims 1-18 of Simpson et al. '649 in view of Riester et al. and Simpson et al. '481.

Each of these rejections is traversed and addressed in turn.

Rejection IV:

This double patenting rejection over the claims of Simpson et al. '481 taken with Riester et al. is faulty for the same reasons stated in rebuttal of Rejection I. Riester et al. is not properly combined with the claims of Simpson et al. '481 any more than its text for the reasons stated above. Moreover, even if combined, the teaching of the claims of Simpson et al. '481 with Riester et al. fails to provide a case for *prima facie* obviousness, and Applicants have also provided a strong showing of unexpected results as evidence of patentability. Thus, the double patenting rejection over the claims of Simpson et al. '481 with Riester et al is without merit and should be withdrawn.

Rejection V:

The double patenting rejection of Claims 13-18 over the combination of the claims of Simpson et al. '481 with Riester et al. and Simpson et al. '649 lacks merit for the same reasons stated above in rebuttal of Rejections II and IV. For the sake of brevity, those reasons will not be repeated but are incorporated herein in their entirety, and the rejection should be withdrawn.

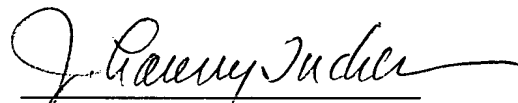
Rejection VI:

Lastly, the double patenting rejection of Claims 19 and 20 over the claims of Simpson et al. '649 in view of Riester et al. and Simpson et al. '481 also lacks merit for the same reasons stated above in rebuttal of Rejections III and IV.

The claims of Simpson et al. '649 are no more useful in supporting an unpatentability rejection as the text, and the mere switching the order of references does not make the rejection correct. Thus, this rejection should be withdrawn.

Applicants have properly addressed all issues raised in the Office Action and in view of the foregoing amendments and remarks, reconsideration of this patent application is respectfully requested. A prompt and favorable action by the examiner is earnestly solicited.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "J. Lanny Tucker", written over a horizontal line.

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If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.